Research on Standards for Barrier-free Tubless Bathrooms

(Research period: FY 2021-2023)

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(Keywords) Elderly people living at home, Accidental drowning, Tubless bathroom, Barrier-free standards

1. Introduction

In recent years, deaths of elderly people living at home due to accidental drowning while bathing have occurred frequently and are increasing in Japan. On the other hand, assistance in which a helper places the bather in a bathtub imposes a heavy burden on helpers, and is accompanied by risk for both the bather and the helper. Although the Japanese are still not accustomed to bathing without a bathtub, it is possible to prevent drowning accidents and reduce the burden on helpers by eliminating the tub from the bathroom and bathing without soaking in a bathtub. In addition, as a result of this reduction in the burden on helpers, family members in the home will be able to assist elderly people safely and easily. Since this will increase the opportunities for bathing, it can also be expected to contribute to an improved quality-of-life (QOL) for the bather.

The Housing Production Department conducted "Research on Standards for Barrier-free Tubless Bathrooms (FY 2021-2023) on bathrooms without a bathtub," in other words, "tubless bathrooms," to arrange design concepts that give appropriate consideration to the needs of elderly people ("elderly-friendly design"), as well as technical standards that can be applied to judgments of safety, etc.

2. Study Items

The main study items in this research are as follows. The following sections present an outline of the respective items. Table 1 gives the definition of a "tubless bathroom," and **Fig. 1** shows an image of remodeling from an existing bathroom with a bathtub to a tubless bathroom.

(1) Study and arrangement of the range of bathers

(2) Experimental verification of the safety, ease-of-use, etc. of tubless bathrooms

③ Development of technical standards, etc. for barrier-free design of tubless bathrooms

3. Study and Arrangement of Range of Bathers

In studying the size, etc. of tubless bathrooms and planning the related experiments, firstly, because the method of bathing differs depending on the physical condition of the user of a tubless bathroom, and the necessary dimensions of the bathroom will also differ accordingly, the relationship between the assumptions about the physical condition of the bather and the nursing care certification class were arranged, as shown in **Fig. 2**. As shown in the figure, the experimental conditions of the bathroom size were specified assuming that persons having physical characteristics that fall within the gray ellipse will be the users of the tubless bathrooms.

[1] Independent bather capable of walking (with bathing

helper)

[2] Use wheelchair in room, use bath chair in bathroom (with bathing helper)

[3] Use assistive-type wheelchair in room, use shower carrier in bathroom (with bathing helper)

Table 1 Definition of tubless bathroom

- A bathroom with no bathtub, a space for bathing that does not need a bathtub.
- Activities such as washing the bather's hair and body and warming the bather's body can be performed with the bather seated on a bath chair or by using a shower carrier (or a wheelchair and bath chair)

• A helper can also enter the bathroom and help with bathing. *In principle, a bathroom with no bathtub is defined those which satisfy the above 3 requirements.



use in standing and sitting ③ Handrail for moving * The size of bathrooms are the same.

Fig. 1 Image of remodeling from an existing bathroom to a tubless bathroom



Fig. 2 Relationship of assumptions about physical condition of bather and nursing care certification class

4. Experimental Verification of Tubless Bathroom Safety and Ease-of-Use, Etc.

Experiments were carried out for verification of the necessary spatial dimensions, handrail positions, etc. of tubless bathrooms and verification of the safety, burden, etc. of actions of the bather and helper. For these experiments, actual-size mockups simulating the tubless bathrooms were installed, and human-subject experiments were conducted using a total of 17 general males and females as the subjects (conducted in December 2022). The outline of the experiments is summarized in **Table-2**. For further details, please refer to the reference literature.

Table2 Outline of experiments

*The lower rows show the data obtained.

[Experiment 1] Position, height, etc. of handrails installed in tubless bathroom

Position and height of handrails to make it possible for the bather and helper to move in the washing space, prevent falling when standing up or sitting down, and maintain posture while bathing.

[Experiment 2] Minimum size of tubless bathroom required for bathing

Inner dimensions of the tubless bathroom that enable bathing actions, separately for the cases of <u>independent walking</u> and assisted walking.

[Experiment 3] Size of tubless bathroom in case a wheelchair, etc. is to be used

Dimensions of the tubless bathroom that enable movement and bathing actions when using a <u>wheelchair</u> or <u>shower carrier</u>, assuming the presence of a helper, as in the above [Experiment 2]

5. Development of Technical Standards, Etc. for Barrierfree Tubless Bathrooms

(1) Required size levels of "tubless bathrooms" (draft)

Based on the results of the verification experiments described above, the required performance levels of tubless bathrooms were studied by following procedure.

(1) Each of the experimental cases of the human-subject experiments is evaluated by experts from the viewpoint of "whether bathing and bathing assistance can be regarded as possible," based on the data obtained by videorecording the experiments, etc.

(2) Whether the actions and movements of the subjects assuming the bather and helper are realistic under the spatial constraints of the bathroom size (inner dimensions W x D) and layout is evaluated in four levels (\bigcirc , \circ , \triangle , ×), and a primary evaluation is made.

③ The evaluation results are summarized and discussed, and based on the results, the evaluators finalize the evaluation.

④ Based on the summary of the expert evaluation, the required levels (draft) of the "Bathroom size (length of short side, area)" are arranged corresponding to the characteristics of the bathers and bathing methods.

The results (examples) of this arrangement are shown in **Fig. 3**.

Eventiment				◎推奨	〇誘導	△標準	×困難
No.	Bathroom type	Bathroom size (W x D)	Area (mZ)	Opening	Wheelchair	Shower carrier	Walk/helper
実験No.	浴室タイプ	浴室サイズ(幅×周行)	面積 (ml)	間口	車いす	シャワーキャリー	歩行・介助者
b16	Existing UB type	1,700×1,800	3.06	800	٥	0	
b4	Existing UB.type	1,600×1,800	2.88	800	0	0	
b1		1,600×1,600	2.56	800	0	0	
al		1,600 × 1,200	1.92	800			٥
c9		1,500×1,600	2.40	800		0	
a18		1,500 × 1,200	1.80	800	×	×	0
b18	Existing UR type	1,400×1,800	2.52	800	0-	0	
b2	Co (jpc	1,400×1,600	2.24	800	Δ	0	
c18		1,400×1,500	2.10	800	\triangle		
c19		1,400×1,400	1.96	800	Δ	×	
a19		1,400 × 1,200	1.68	800	×	×	٥

ommended 🛛 Guidance 🛆 Standard 🗙 No

Fig.-3 Arrangement of evaluation results (example)

(2) Design Guideline for Tubless Bathrooms for New Construction and Remodeling of Existing Housing (Draft)

Based on the content of the study up to this point, the captioned Guideline was compiled with the aim of popularizing tubless bathrooms. Since the main assumed readers are residents and designers who are studying the installation of a tubless bathroom, the concept of the tubless bathroom, its required functions and their levels, and examples that may provide hints for design are introduced (a draft of the Table of Contents is shown in **Table-3**).

Table-3 Table of Contents of Guideline (Draft)

Chapter 1 Introduction

Purpose, composition of Guideline, definitions of terms Chapter 2 What is a Tubless Bathroom?

- Definition and features of tubless bathroom, image of use, characteristics of assumed users
- Chapter 3 Functions and Performance of Tubless Bathrooms Functions of tubless bathrooms, required levels of tubless bathrooms and their concepts, dimensional standards for tubless bathrooms

Chapter 4 Tubless Bathrooms Considering Ease-of-Use, Safety and Peace of Mind

Response to characteristics of users, introduction of examples for remodeling to a tubless bathroom

Chapter 5 Conclusion

Proposal of the tubless bathroom as a new bathing style, future outlook and issues

6. Conclusion

A summary of these research results, the required levels of tubless bathrooms, and a draft of the Guideline will be compiled as a TECHNICAL NOTE of the National Institute of Land and Infrastructure Management (NILIM). The results are scheduled to be released during FY 2024.

For more information

- Research on Technical Standards for Barrier-free Tubless Bathrooms Part 1 – Outline of Human-Subject Experiments Related to Size and Dimensions, Etc., Summaries of technical papers of the FY 2023 Annual Meeting (Kinki) of the Architectural Institute of Japan, pp. 1255-1256, Aug. 2023
- 2) Research on Technical Standards for Barrier-free Tubless Bathrooms Part 2 – Trial of Use of 3-Dimensional Measuring System in Human-Subject Experiments, Summaries of technical papers of the FY 2023 Annual Meeting (Kinki) of the Architectural Institute of Japan, pp. 1257-1258, Aug. 2023